C. MILLER.

ROTARY ENGINE.

APPLICATION FILED NOV. 3, 1908.

924,173. Patented June 8, 1909.

Fig. 1.

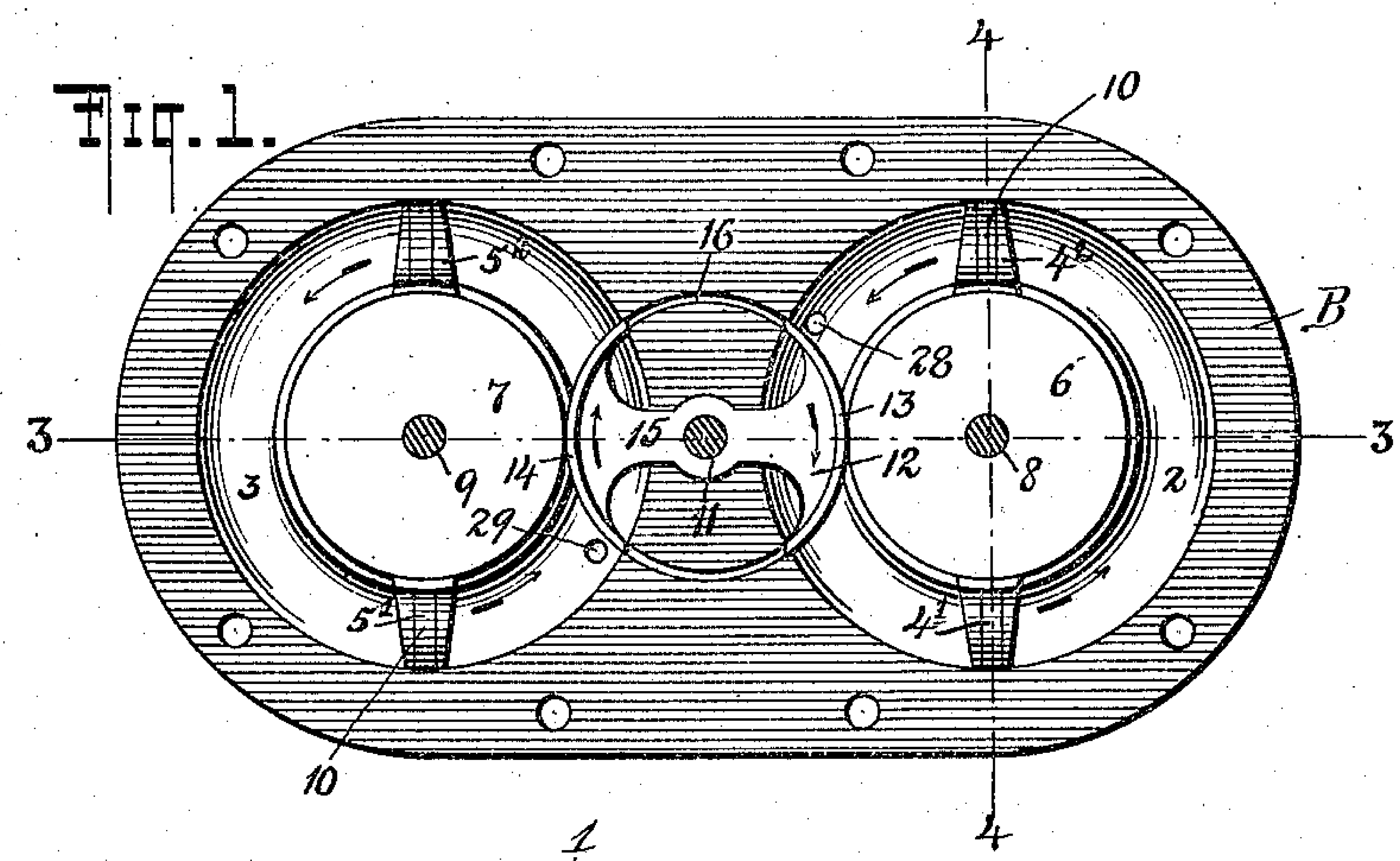


Fig. 2.

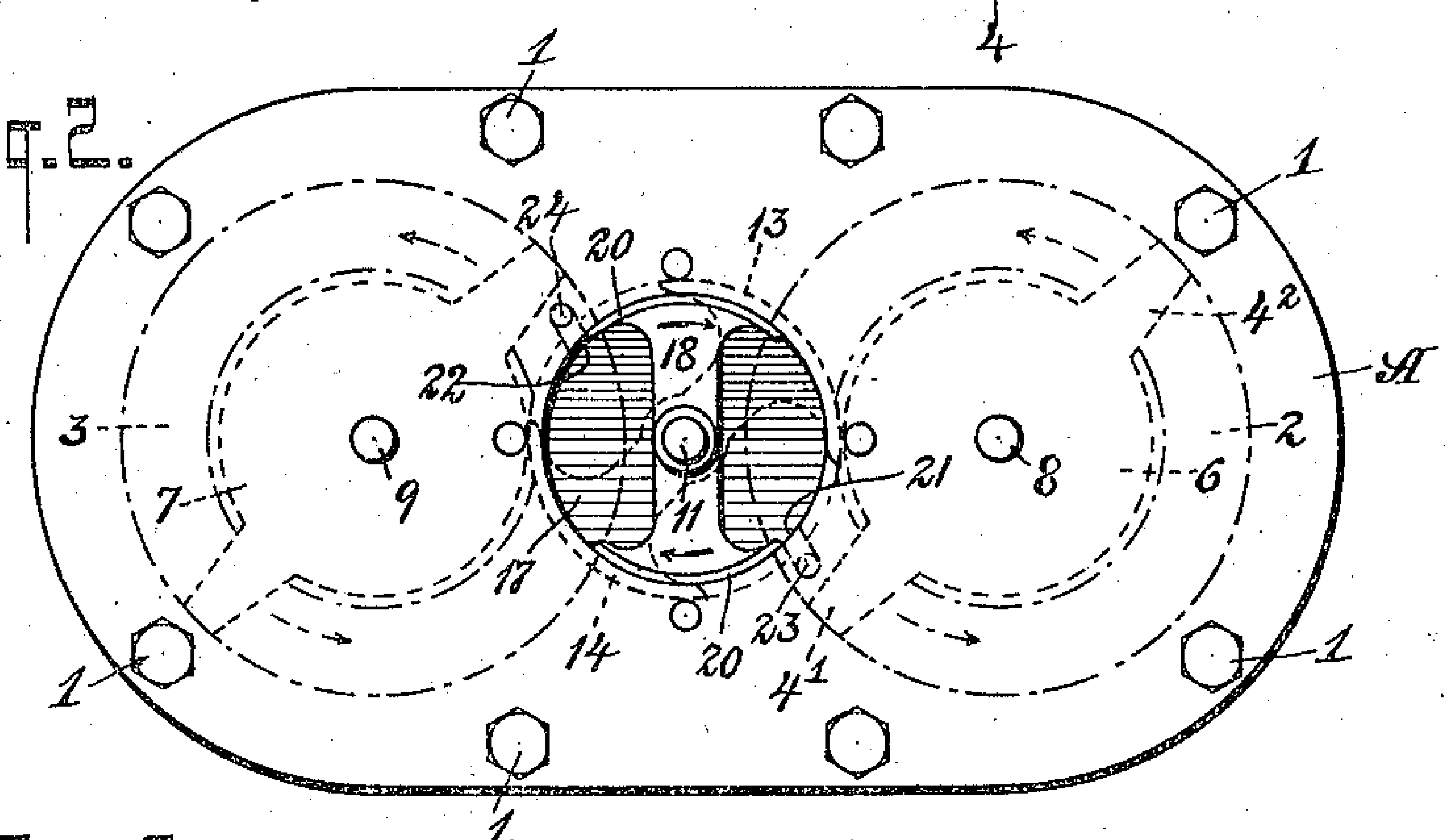


Fig. 3.

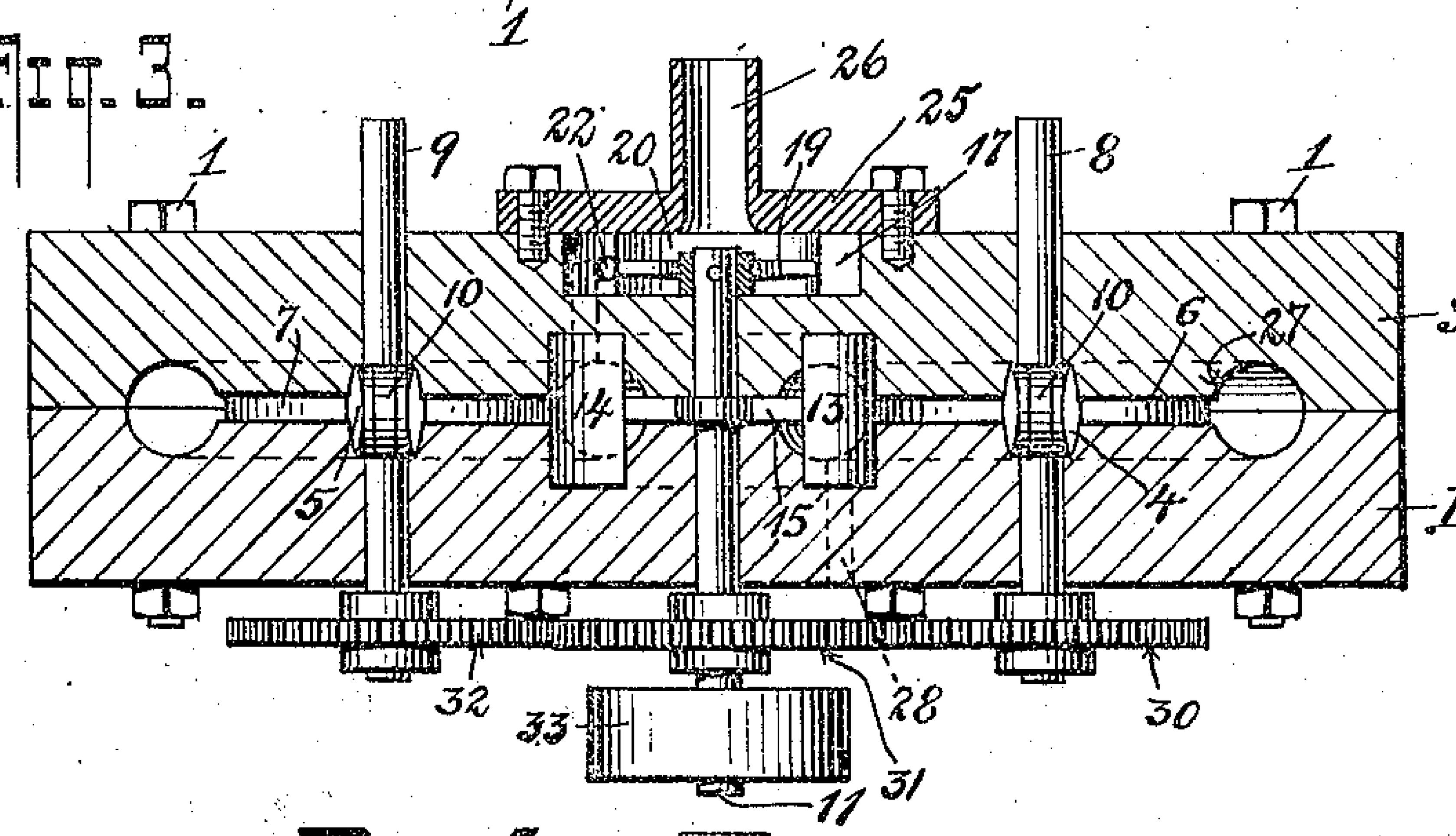
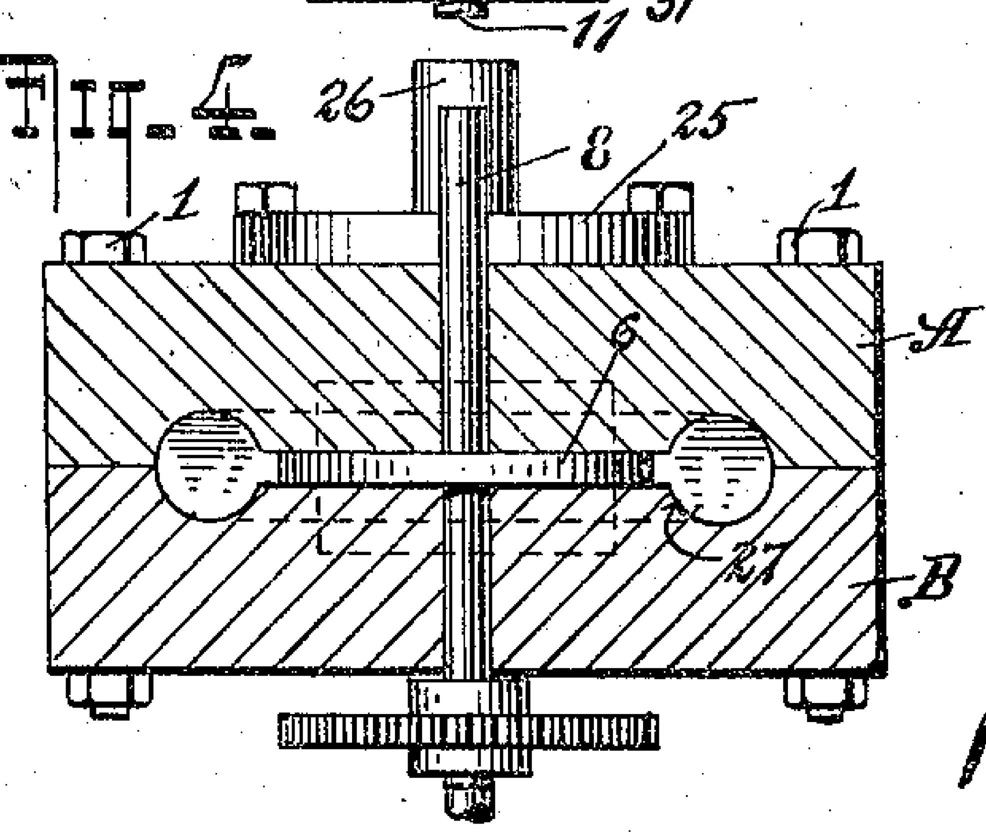


Fig. 4.



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# UNITED STATES PATENT OFFICE.

CHARLES MILLER, OF NEW YORK, N. Y.

ROTARY ENGINE.

No. 924,173. Specification of Letters Patent. Patented June 8, 1909.

Application filed November 3, 1908. Serial No. 460,873.

*To all whom it may concern:*

Be it known that I, Charles Miller, a citizen of the United States, residing in the city, county, and State of New York, have invented a new and useful Improvement in Rotary Engines, of which the following is a full, clear, and exact description.

My invention relates to that type of rotary engine in which one or more pistons are driven continuously in one direction or the other about a central axis, and in an appropriate endless chamber to which said pistons are fitted, the actuating medium being any suitable gas, such as steam or air, admitted to the chamber, under pressure and at suitable times.

My invention relates more particularly to certain definite modes of construction and arrangement of parts, the exact character of which will be brought out in the following specification read in connection with the drawings accompanying in which—

Figure 1 is a side elevation of my improved engine with its anterior half casing removed; Fig. 2. is a side elevation of the completely assembled engine save for the valve chamber cover which is absent; but with the functional parts at a different position in their cycle of movement than in the other figures. Fig. 3. is a longitudinal section taken along the line 3—3 of Fig. 1, but with both half casings in place; Fig. 4. is a transverse section of the completely assembled engine taken along the line 4—4 of Fig. 1.

A principal object of my invention is to obtain an increased efficiency in engines of the stated type by decreasing leakage and loss of the actuating gas.

A further object is to decrease the lateral pressure on bearings, as well as in other functional parts, thus making for increased durability.

A further object is to simplify the design and assembly of parts thus facilitating the making of necessary repairs as well as lessening their cost.

Further objects will appear as the specification proceeds.

Referring to the drawings, which illustrate a preferred embodiment of my engine when operated by steam or compressed air, A and B are metal castings, bolted together by bolts 1, comprising a main casing in which are formed the two annular steam chambers, 2 and 3. These chambers are preferably circular in section and have their central planes lying in the contact plane of the two half-casings.

In each steam chamber is a pair of diametrical pistons 4, 4, and 5, 5, rigidly fixed to thin cores, 6, and 7, which are themselves fixed to shafts, 8 and 9, and upon and with which each piston system is adapted to revolve. To insure a steam tight connection between each piston and the cylinder, spring rings, 10, are peripherally attached as is practiced in reciprocating engines.

Parallel with and on the line of the two piston shafts, and midway between them, is a shaft, 11, which carries an abutment 12. This is a structure comprising two identical thin tubular segments or heads, 13 and 14, having sides and ends respectively parallel and perpendicular to the axis of the segments (the axis of shaft 11), which are centrally united, as also fixed to the shaft, by a thin core 15. These segments are adapted to move in an annular abutment slot, 16, which, like the steam chambers, is formed in the main casing, and intersects each of said chambers as shown. This slot is axially longer than the diameter of the steam pistons 4, 4, 5, 5, thus extending beyond the steam chambers on each side (see Figs. 3 and 4).

In the top casing and central with shaft 11 is a cylindrical valve chamber 17 in which is a valve 18 consisting of a thin septum 19 having similar annular segments, 20, at each end; this valve is rigidly fixed to the abutment shaft 11, thus rotating with it and the abutment, and the thin end septa are snugly fitted to the peripheral walls of the valve chamber. Diametrally opposite and on a diagonal two rectangular slits or ports 21, 22, are cut in the valve chamber periphery and are continued inwardly to emerge, finally, in a downward direction into the two steam chambers at 23, 24. As the valve, 18, revolves it will alternately and simultaneously completely cover and then uncover the ports 21, 22, thus correspondingly admitting and shutting off steam admission to the steam chambers, the valve chamber cover, 25, with its inlet pipe, 26, being assumed in place and the steam turned on.

The cores 6, 7, to which the pistons are fixed may and should be quite thin so as to minimize the lateral pressure transmitted thereby to the journal boxes; they must, of course, be well fitted to and closely embraced by the inwardly projecting bosses 27 which form the inner periphery of each annular steam chamber. And, further, these cores must be of less diameter than the contiguous cross section of the bosses; and the abutment heads 13, 14, must be determined so as to be tangent to the cores as they both revolve.

Exhaust steam ports 28, 29, similar to the inlet ports but of larger section, are placed at the side of the engine opposite the inlet ports and on the other diagonal.

The three shafts 8, 9, and 11 carry, on one side, spur gear wheels, 30, 31, 32, of equal diameter and meshing into one another, thus compelling the shafts to turn with the same angular velocity; a smooth pulley, 33, attached to one of these shafts, permits power to be taken from the engine.

The valve 18 is not lined up with the abutment 12 but angularly offset as shown in Fig. 2.

I will now explain the working of my improved engine the moving parts being supposed as in Fig. 2. Steam having been admitted to the inlet pipe 26, fills the valve chamber 17, passing above and below the transverse connecting septum 19, and goes through the ports 21, 22, which have just been uncovered by the segments 20, 20, and through the inner ports 23, 24, to the steam chambers 2, 3.

Considering the right hand side of the engine only, since the two sides are similar and simply add their effects to one another, we see that abutment segment 13 has just bridged the steam chamber 2 while piston $4^1$ (below) has just passed the abutment slot and is being driven forward by the steam which is flowing into the steam chamber through the port 23 between it and the abutment head. Owing to the thinness of the abutment core 15 practically the only pressure effective as to the abutment system is that acting upon the abutment heads and this being substantially radial as to shaft 11, instead of tangential, there is but a negligible component of this steam pressure effective to retard the abutment. Steam may be thus left on until the abutment segment 13 has advanced about 90° from the position of Fig. 2 at which time said segment will be about to leave the core and bosses 27, 27 thereby enabling steam contained in the steam chamber to reach the exhaust port; for about a second 90°, or until abutment segment 14 gets around to again block the steam chamber, 2, steam must now be cut off. This completes a cycle of 180° and each succeeding 180° cycle is exactly like it.

If the angle included by each valve segment 20 be the same as that included by the abutment segment 13 the full steam pressure will be active upon the pistons during the whole time that steam is in the steam chambers from admission to exhaust. But if the valve segments be given a greater angle than the abutment segments, then steam will be cut off before exhaust, and there will be a period of expansion before exhaust, this period becoming greater as the angle included by the valve segments becomes greater; efficiency obviously depends upon the angle chosen. Efficiency also depends upon other factors as *e. g.*, the angle between valve system and abutment system.

Owing to the fact that the abutment segments 13 and 14 are held at their ends by the slot 16 and at their middles by the core 15 they may be made exceedingly thin without being too weak for their purpose. The intersection of slot 16 with the steam chambers 2, 3, therefore may be an opening materially narrower than a piston ring and for this reason and for the further reason that the slot crosses the steam chamber obliquely whereas the piston rings are always square, said rings will pass over the slot intersections without jumping, leaking, or being obstructed in any way.

I am aware that rotary engines comprising pistons revolving in endless chambers and coöperating with cyclically removable abutments are not new. In all of such engines, however, difficulty has been had in inserting and removing the abutment from the steam chamber without so breaking the walls of the steam chamber as to make a tight fitting piston an improbability. With my improved construction the pistons may be fitted as snugly and will work as smoothly as in engines of the rectilinear type.

I have described my improved engine as for steam or compressed air; it is obvious, however, that other gases under pressure might also be used as *e. g.*, exploded mixtures such as alcohol and air, gas and air, gasolene and air, which mixtures may have been separately exploded and then admitted to the piston chambers. My improvements are also, of course, equally applicable to rotary engines when reversed *i. e.*, when used as compressors instead of prime movers.

Many changes of detail may be made without departing from the spirit of my invention which I have embodied in the following claims.

I claim:

1. In a rotary engine having opposite rotary piston systems coöperating with a central abutment, the combination of a casing containing annular steam chambers of substantially circular section, rotating pistons fitted snugly to said chambers, and central abutment heads adapted to rotate in an annular chamber intersecting each steam chamber, whereby the continuity of said steam chambers is cyclically interrupted.

2. In a rotary engine having opposite rotary piston systems coöperating with a central abutment, the combination of a casing containing annular steam chambers of sub-

stantially circular section, rotating pistons fitted snugly to said chambers, and a central abutment comprising thin tubular head segments united by a transverse core and adapted to rotate in a tubular passage to which they are closely fitted said passage completely intersecting each steam chamber, whereby the continuity of said steam chambers is cyclically interrupted.

3. In a rotary engine having opposite rotary piston systems coöperating with a central abutment, the combination of a casing containing annular steam chambers of substantially circular section; pistons, provided with packing rings, and joined by a thin transverse core, rotating in said chambers; and a central abutment comprising opposite thin tubular segments united by a thin transverse core, and adapted to rotate in a tubular passage to which said segments are closely fitted, said passage completely intersecting each steam chamber, and having a radial depth substantially less than the thickness of a single packing ring and extending axially beyond the steam chambers on each side, as and for the purpose described.

4. In a rotary engine, a casing containing annular steam chambers of substantially circular section in which closely fitted pistons are turnable and containing also a tubular passage axially central to the steam chambers and completely intersecting each of said chambers, said tubular passage being adapted also to receive movable and closely fitting abutment heads, whereby continuity of the steam chambers is cyclically interrupted.

5. In a rotary engine, a casing containing annular steam chambers of substantially circular section in which closely fitted pistons are turnable and containing also a tubular passage axially central to the steam chambers and completely intersecting said chambers, said tubular passage extending axially beyond the annular steam chambers on each side and having a radial depth substantially less than the thickness of the steam piston and adapted also to contain closely fitting tubular abutment heads, whereby continuity of the steam chambers is cyclically interrupted.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES MILLER.

Witnesses:
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F. F. KIRKPATRICK.